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ABSTRACT

This digest examines some of the literature on technology transfer in the context of higher education, noting that the practice of capitalizing on academic research for commercial purposes has the potential to generate financial resources for the participating institutions of higher education. Several examples of technology transfer are cited, including initiatives at the Massachusetts Institute of Technology such as the university's Leaders in Manufacturing program and its Industrial Liaison Program, with a membership that includes more than 300 companies. Another partnership cited involves the Washington University Medical School (Missouri) and the Monsanto Company, which seeks new discoveries relating to the health field. Critics of technology transfer claim that the practice goes against the four norms characteristic of the practice of science cited by Robert Merton: namely, universalism (shared scientific ideas), communism (collective ownership of knowledge), disinterestedness in personal gain, and organized skepticism (independent validation), and suggests that successful practice of technology transfer must take these values into account, as well as the ethical issues and financial and research gains. (Contains 7 references.) (JM)

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Though technology transfer has become a recent buzzword in the context of higher education, it is not a new practice. Both the University of Wisconsin and the Massachusetts Institute of Technology have practiced it since the early twentieth century. However, the concern for creating income in institutions of higher education during the last 20 years has drawn the concept of technology transfer as a development strategy to the forefront of campus issues making the topic as controversial as it is appealing. The purpose of this digest is to define and discuss technology transfer in the context of higher education. Examples of university technology transfer will be given, and issues surrounding the topic will be discussed.

The term technology transfer is used to describe various practices in which a relationship between at least two entities is formed with the intent of capitalizing on research for commercial purposes. In the case of universities, the research or invention is usually provided by the university, while the mechanism of commercialization is provided by private industry. Examples of activities that fall under the domain of technology transfer include: university licensing and patenting; small business development centers; research and technology centers; business incubators; investment/ development and sponsored research and contracting. Not surprisingly, doctoral granting institutions and institutions specializing in engineering and health related issues account for the majority of participants in this practice in the American system of higher education (Dill, 1994). Although it has been suggested that smaller and medium sized institutions also have the ability to develop and benefit from technology transfer (artinussen, 1993).

According to Sayetat (1993), the objectives of technology transfer are two-fold. First, educational institutions have a social responsibility to participate in the generation of new knowledge. This includes the development and transfer of information to industry. Second, because public funds to support institutions of higher education have been diminishing, these institutions must seek development sources. Technology transfer has the potential to bring in financial resources not only for the participating academic unit, but for the entire institution as well. Thus a relationship is formed in which universities respond to the expectations of industry and gain in return valuable financial resources. In order for these objectives to be met, available resources and the commercial value of an initiative must be evaluated and a supportive institutional environment created.

Examples of Technology Transfer

From its inception, the Massachusetts Institute of Technology (MIT) has shared relationships with private industry. In addition to generating financial resources, MIT uses technology transfer as a strategy to increase American competitiveness in the global market and to facilitate the development of basic research into applied research (Bowie, 1994, p. 123).

As a result of this diverse approach to technology transfer, MIT supports a variety of related activities that incorporate the institution staff, faculty, students, and industry. For instance, various engineering departments participate in work-study and internships programs with industry. This activity benefits the students, the institution, and industry. MIT also offers specialized degree programs designed to meet practical industry needs. One example is of this is the MIT Leaders in Manufacturing program. This program seeks to educate managers and engineers who will contribute to the entire process of product manufacturing (p. 124). MIT also offers various short courses aimed at keeping professionals abreast of the latest technological developments. They share industrial partnerships and enjoy the support of sponsored research. Finally, for more than 40 years, MIT has run the Industrial Liaison Program (ILP) that includes membership of over 300 companies (p. 125). Most of the participating compans count on technology for their success. By partnering, MIT and the companies can share the dual responsibility of developing an idea from theory into practice.

The Monsanto Company invests about 3 percent ($15-20 million) of their total research and development monies to university technology transfer annually (Bowie, p. 138). Monetarily, its largest relationship is with the Washington University Medical School in St. Louis, Missouri. The partnership calls the results of this relationship, discovery research. The aim is neither philanthropic nor to conduct clinical trials, but rather to seek new discoveries relating to the health field. In addition to investing research dollars, the company also provides the knowledge and skills of their own scientists. Once an innovation has been discovered, Monsanto develops the discovery into products.

While the success stories of technology transfer are numerous, the creation of relationships between universities and industry as a topic is controversial. Arguments against the practice of technology transfer generally emphasize the difference in values between academe and industry. In his 1942 essay, "The Normative Structure of Science" Robert Merton identified four norms characteristic of the practice of science. These include: universalism, communism (collective ownership), disinterestedness in foregoing personal gain and organized skepticism (as cited in Bowie, 1994 p. 86). Critics argue that technology transfer has the potential to violate each of Merton's four norms. For this reason, the following criticisms of technology transfer will be organized under each of Merton's four characteristics.

Univeralism

A benchmark of research in higher education has been the accepted understanding that scientists share the fruits of their labor. This is founded on the idea that current and future research is based on the discoveries of scientific predecessors. Critics argue that battles over intellectual property rights and licensing could corrupt the openness among scientists replacing it with a proprietary environment more like that found in private industry. Moreover, others provide evidence that patenting and licensing are not always profitable. Daines (1996) cites that the process is expensive, risky, and rarely results in profitable application.

Communism (Collective Ownership)

If scientific knowledge is collective property, then it cannot be private property (Bowie, p. 86). Returning to intellectual property rights and licensing, by owning the rights to a discovery, along with the right to decide who can or cannot use it, scientists and institutions violate this scientific norm.

Disinterestedness in Personal Gain

Another major criticism of technology transfer is that scientists will be swayed by private industry by way of financial investment. Some argue that industry involvement in research and development will de-emphasize the basis of scientific research of generating knowledge for knowledge's sake in exchange for directed research influenced by the concerns of the investing company or firm. (McWilliam, 1990).

Organized Skepticism

University research is most often validated through the publication process. An innovation or discovery is documented in the form of a journal article, which has been reviewed by members of the given field (McBrierty, 1993). Conversely, industry research is validated in the marketplace, without peer review (Bowie, p. 85). Partnerships between the two may consist of an agreement by the institution to delay publication so that the industry partner can develop and announce the related product. Critics warn that this approach may not be appropriate in some fields of research and that ultimately the quality of research is compromised.

As illustrated by the critics of technology transfer, differences between the sectors lay along a range, from conceptions of the definition and purpose of research to how to go about validating a discovery. McBrierty (1993) suggests that bridging the cultural (value) gap between higher education and industry is the first step in optimizing the potential of technology transfer. He contends that communication and structure are two ways of approaching a solution to the cultural gap. According to McBrierty, communication skills must be developed between higher education, industry, and the greater society in order to transmit information. This means that academics acknowledge that discovery can and should be translated into application on one hand. On the other hand, it means that industry must understand the importance of basic research in building the knowledge base. McBrierty also suggests that the very structure of the partnerships should be carefully considered. This includes cooperation between academ departments and industry. It also includes the design of processes that are flexible enough to meet the diverse needs of industry, while at the same time maintaining the separate identities of both higher education and industry. This is called industry/ university symmetry in which. "the capacity of a company to assimilate advances in research depends upon the availability of technical personnel within the company who are able to enter into meaningful dialogue with university researchers" (Phillips as cited in McBrierty, 1993).

Given the financial constraints placed on higher education, technology transfer is an appealing avenue for creating institutional revenue. However, as illustrated in this digest, successful practice of this strategy needs to take into account value and ethical issues in addition to financial and research gains.

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